Visual Acuity as a Function of Age and Sex

العمر والجنس وتأثيره على حدة الإبصار

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Abstract

A total of (607) normal subjects (289 males& 318 females) where tested for visual acuity by using Snellen charts. The subjects are divided into five age groups at (10) years intervals.

They showed a marked decreasing in a percent visual acuity of right and left eye with advancing age for both sexes. The decreasing began obvious at E-chart line (6/12) especially at old age groups (40-49) and (50-59) years.

Statistical analysis by using chi tests showed no significant difference in the percent visual acuity between right and left eyes and between males and females in all E-chart line for all age groups.

Also it appears no significant difference between age groups [(10-19) & (20-29)], [(10-19) & (30-39)], [(30-39) & (40-49)] & [(20-29) & (30-39)] years for all E-chart line for both sexes, but a significant difference has been found between age groups [(10-19) & (40-49)] ,[(20-29) & (40-49)],[(10-19) & (50-59)] ,[(20-29) & (50-59)], [(30-39) & (50-59)] & [(40-49) & (50-59)] years for different E-chart line for right & left eye and for both sexes.

الملخـص

تم تحديد الإبصار لـ (607) شخص لكلا الجنسين (289 ذكور, 318 إناث) باستخدام اختبار سنيل نوع (E-chart) لفحص حدة البصر. قسمت العينة إلى خمسة مجاميع (10-19), (20-29), (30-39), (40-49), (50-59) سنة.

أظهرت النتائج حصول انخفاض في حدة البصر لكلا من العين اليمنى واليسرى بتقدم العمر ولكلا الجنسين. الانخفاض يظهر بصورة واضحة عند خط الفحص (12/6) فما دون وخصوصا عند مجاميع الأعمار الكبيرة (40-49) و (50-59) سنة.

اظهر التحليل الإحصائي باستخدام (اختبار كاي) عدم وجود فرو قات معنوية في النسبة المئوية لحدة الإبصار مابين العين اليمنى واليسرى وكذلك مابين الإناث والذكور ولجميع خطوط اختبار سنيل ولكافة مجاميع الأعمـــار.

أيضا لم تظهـــر فرو قـــات معنويـــــة في النسـبـة المئويـــــة لحـــــدة الإبصـــــار مـابيـن مجامـــيع الأعمـار [(10-19)&(20-29)]، [(10-19)&(30-39)], [(30-39)&(40-49)],[(20-29)&(30-39)] سنة ولكافة خطوط اختبار سنيل ولكل من العين اليمنى واليسرى واليمنى ولكلا الجنسين.

أما الفرو قات المعنوية في حدة الإبصار فظهرت في مجاميع الأعمار[(10-19)&(40-49)],[(20-29)&(40-49)],[(10-19)&(50-59)] ,[(20-29)&(50-59)], [(30-39)& (50-59)],[(40-49)&(50-59)] لخطوط متباينة من اختبار سنيل و لكل من العين اليمنى واليسرى ولكلا الجنسين.

Introduction

Visual acuity is a test of macular function [1] and is the best single test of ocular function [2].It can be altered by ocular pathology or by refractive error.

The assessment of visual acuity by means of letter charts has along history. The traditions carry back to the 1860, when sweet Snellen [3] presented the first version of his famous chart and Donders [4] an advocated its use for simultaneous determinations of visual acuity and refractive errors.

Visual acuity is commonly tested using the Snellen test type. It is constructed on the principle that two distant points can be visible as separated only when the minimum angle subtended by them at the nodal point of the eye is one minute [5]. This forms the standard of normal visual acuity.

Although considerable body of knowledge exists concerning the physiological basis of visual acuity [6,7,8] very little is known about the causes of its age dependence.

The aim of this study is to find out the effect of age on visual acuity in normal subjects by measuring the percent visual acuity in all age groups for both sexes and comparative between them.

Material & Method

A total of 607 normal subjects (289 males & 318 Females) where tested for visual acuity by using Snellen tests chart type (illiterate E) as in Figure (1), which consists of a series of letters arrange in lines (6/60 ,6/30, ,6/21, 6/15, 6/12, 6/9,6/6). The size of the letters gradually diminishes from above downwards and numerical number is written underneath each line. Table (1) shows the visual acuity notation for distance corresponding to illiterate E acuity chart [5].

The test is doing by putting the chart at (6m) from the person. The chart should be well illuminated and illumination should not fall below 20 foot candle [9]. The person is asked to read the test type after covering one eye, either by a card board or by palm of the hand.

The visual acuity is expressed as a fraction, the numerator of which is the distance of chart from the patient (6m) and the denominator is the numerical number written underneath the line up to which the patient can read, then the examination should be repeated for the second eye.

The majority of the subjects tested were Kufa university students and their families. They were carefully examined and questioned regarding previous eye disease. Those a abnormal were excluded from the study excepted the eyes with refractive errors, the tested done without glasses.

The individual are divided into five age groups at (10) years interval. The percent of visual acuity for each line of Snellen charts were estimated for all age groups in both sexes for right and left eyes and recorded as in Tables (2) and (3). Then the data are statistically analyses using Chi tests [10].

Results and Discussion

Tables (2) & (3) shows the percent visual acuity of right and left eyes for male and female at different age groups. It can be shown from these tables that the visual acuity of right and left eyes decreased as the value of E-chart line increased for all age groups of males and females. Also it can be seen that visual acuity of right and left eyes decreased with advanced age for both sexes.

Figures (2) and (3) represent the percent visual acuity of males for right and left eyes respectively at different age groups. These Figures show a marked decreasing in visual acuity with ages for right and left eyes for all age groups. The decreasing began obvious at E-chart line (6/12) and below, especially at old age groups (40-49) & (50-59) years.

Maximum decreasing in the visual acuity appears at E-chart line (6/6) for all age groups especially at old age groups (50-59) years, which shows a decreasing to about 10%.

Figures.(4) and (5) represent a percent visual acuity of females for right and left eyes respectively at different age groups. From these Figures one can. show a marked decreasing in the visual acuity with ages for right and left eyes for all age groups. The decreasing began obvious at E-chart line (6/12) and below, especially at old age groups (40-49) & (50-59) years.

Maximum decreasing in visual acuity appears at E-chart line (6/6) for all age groups especially at old age groups (50-59) years, which shows decreasing to about 0%.

Figures (6) and (7) represent deterioration of a percent visual acuity of right and left eyes of males with age at different E-chart lines. The decreasing of the visual acuity with age began clearly at E-chart lines (6/12), (6/9) and (6/6) and most marked decline occurred at old age groups (40-49) & (50-59) years.

Figures (8) and (9) represent deterioration of a percent visual acuity of right and left eyes of females with age at different E-chart line. The decreasing of visual acuity with age also begun clearly at E-chart line (6/12), (6/9) and (6/6) and most marked decline occurred at old age groups (40-49) and (50-59) years. L. Frisen found the analysis of dependence of visual acuity on age showed a monotonic rise towered the age of 25 years and a gradual decline thereafter and the most marked decline occurred after the age of 60 yrs [6]. The decline of visual acuity with higher age

may be easier to explain than the rise occurring during adolescence. Another explanation has been forwarded by Weale [11], who proposed that the change was due to an age-dependent loss of neural elements in visual pathways.

Statistical analysis by using Chi tests performed in order to find any significant differences between right and left eyes for all age groups and in all E-chart line, the results showed no significant difference.

Also it is found no significant difference between male and female in all E-chart line for all age groups.

Chi tests also performed to find any significant difference between age groups for right and left eyes for both sexes and the results tabulates in Table (4). As shown form Table (4), there is no significant difference in percent visual acuity of right and left eyes between age groups [(10-19) & (20-29)], [(10-19) & (30-39)], [(30-39) & (40-49)] & [(20-29) & (30-39)] years for all E-chart line for both sexes. The first significant difference appears at age groups [(10-19) & (40-49)] & [(20-29) & (40-49)] at E-chart line (6/21) for right and left eyes of females, also for E-chart line (6/15),(6/12),(6/9) &(6/6) for right and left eyes of males and females. This means that the physiological effects of age on visual acuity appear at age groups (40-49) yrs. But the age groups [(10-19) & (50-59)] & [(20-29) & (50-59)] show significant difference nearly at all E-chart line for both sexes. Also a significant difference appears at age groups [(30-39) & (50-59)] & [(40-49) & (50-59)] nearly at E-chart line (6/15),(6/12),(6/9),&(6/6).

Fig (1) Snellen tests chart type (illiterate E) that used in research.

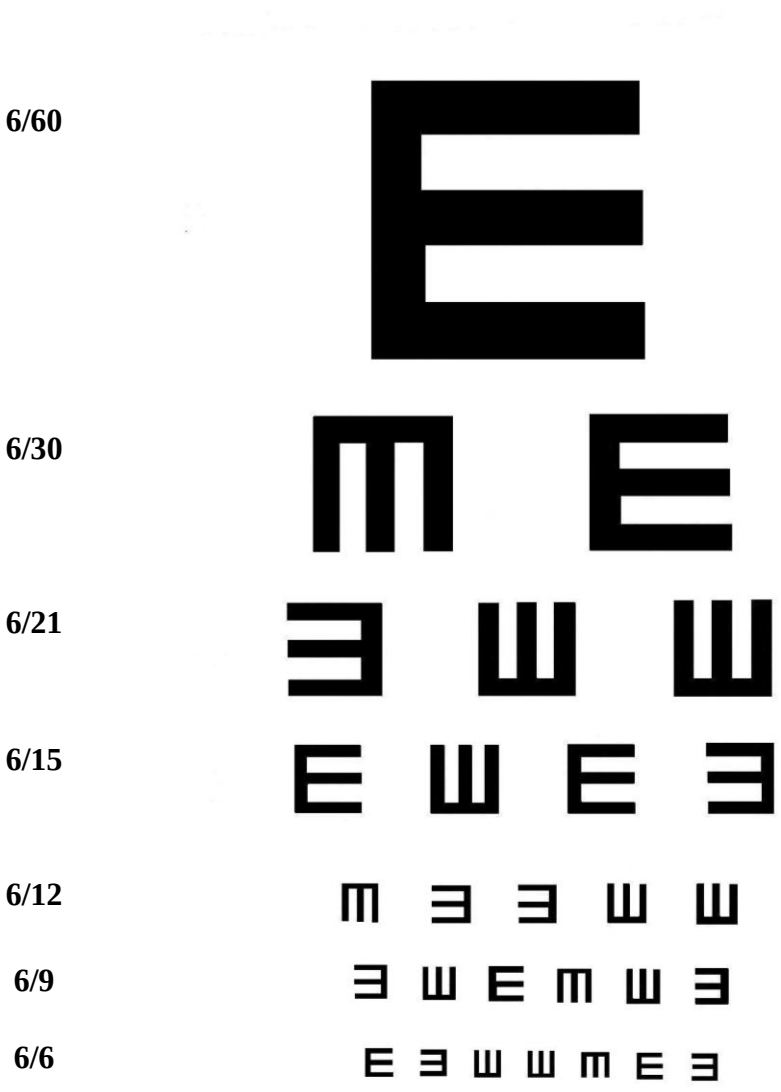

Table (1) Snellen chart line and its value in rad and minute.

Snellen Chart line			Visual angle	visual angle
No. of line	Metric	Decimal notation	(min)	(rad)
1	6/60	0.1	10	$29x10^{-4}$
2	6/30	0.2	5	$14.5x10^{-4}$
3	6/21	0.29	3.5	$10.15x10^{-4}$
4	6/15	0.4	2.5	$7.25x10^{-4}$
5	6/12	0.5	2	$5.8x10^{-4}$
6	6/9	0.67	1.5	$4.35x10^{-4}$
7	6/6	1	1	$2.9x10^{-4}$

Table (2) percent visual acuity of right& left eye for male at different age groups.

E-Chart line		10-19		20-29		30-39		40-49		50-59	
		Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.
		16.1	106	26.4	84	34	40	44.3	39	53.7	20
		R	L	R	L	R	L	R	L	R	L
6/60	0.1	100%	100%	98.8%	100%	100%	100%	100%	100%	95%	100%
6/30	0.2	99.1%	99.1%	97.6%	98.8%	97.5%	97.5%	97.4%	97.4%	90%	95%
6/21	0.29	97.2%	97.2%	95.2%	96.4%	92.5%	92.5%	89.7%	89.7%	85%	85%
6/15	0.4	95.3%	96.2%	95.2%	94.1%	87.5%	87.5%	84.6%	84.6%	70%	75%
6/12	0.5	90.6%	89.6%	89.3%	88.1%	80%	80%	74.4%	74.4%	35%	45%
6/9	0.67	81.1%	81.1%	79.8%	79.8%	67.5%	67.5%	59%	53.9%	25%	25%
6/6	1	67.9%	65.1%	66.7%	60.7%	52.5%	50%	38.5%	35.9%	10%	10%

Table (3) percent visual acuity of left and right eye for female at different age groups.

E-Chart line		10-19		20-29		30-39		40-49		50-59	
		Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.
		15.9	109	23.2	114	34.3	37	44.4	34	52.3	24
		R	L	R	L	R	L	R	L	R	L
6/60	0.1	100%	100%	100%	99.1%	100%	100%	97.1%	97.1%	95.8%	95.8%
6/30	0.2	99.1%	99.1%	99.1%	98.2%	97%	97.3%	94.1%	94.0%	91.7%	83.3%
6/21	0.29	99.1%	97.2%	98.3%	96.5%	94.6%	94.6%	91.2%	85.3%	83.3%	79.2%
6/15	0.4	94.5%	92.7%	93.8%	92.1%	91.9%	89.2%	82.4%	79.4%	66.7%	58.3%
6/12	0.5	90.8%	88.1%	87.7%	86%	83.8%	81.1%	67.6%	70.6%	25%	20.8%
6/9	0.67	81.7%	79.8%	80.7%	76.3%	73.0%	70.3%	52.9%	55.9%	16.7%	12.5%
6/6	1	65.1%	70.6%	64%	61.4%	59.5%	51.4%	38.2%	35.3%	0 %	0%

Table (4) Statistical analysis of percent visual acuity between age groups for left and right eye at different sexes.

E	10-19 20-29				10-19 30-39				10-19 40-49				10-19 50-59				20-29 30-39				20-29 40-49				20-29 50-59				30-39 40-49				30-39 50-59				40-49 50-59			
	F		M		F		M		F		M		F		M		F		M		F		M		F		M		F		M		F		M		F		M	
	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L
6/60													○	○	○										○															
6/30													○	○	○										○															
6/21									○	○			•	•	○	○					○	○			•	•		○												
6/15									○	○	○	•	•	•	•	•					○	○	○	○	•	•	•	•					○	•						
6/12									•	○	○	•	•	•	•	•					•	○	○	○	•	•	•	•					•	•	•	•	•	•	•	○
6/9									•	•	•	•	•	•	•	•					•	○	○	○	•	•	•	•					•	•	•	•	•	•	•	○
6/6									•	•	•	•	•	•	•	•					•	•	•	○	•	•	•	•					•	•	•	•	•	•	•	○

Note: (•) Significant difference at P < 0.01

(○) Significant difference at P < 0.05

References

1. **David W Powers, Steven A Meador** " Testing visual acuity in the Emergency " *Annals of Emergency Medicine 15:7 July (1986)*
2. **W. H. Havener** "synopsis of Opthalmology" *ed 4.St Louis, CV Mosby Co, (1975)*
3. **L. Frisen and M. Frisen** *"* How Good is Normal Visual Acuity " *Albrechtvon Graefes Arch klim ophthalmol, 215:149-157. (1981).*
4. **F.C. Donders** "Die Anomalien der Refraktion und Accomodation des Auges" *Wien Braumuller* (1866)
5. **D. D. Michaels** " Visual Optics and Refraction" *second Edition The C.V. Mosby Company. , (1980)*
6. **L. Frisen** " The neurology of visual acuity " *brain 103,639,670.(1980)*
7. **G. Heron** " Relationship between visual acuity and observation distance" *Ophthal.Physiol. Opt. Vol.15, No. 1, 23-30.(1995).*
8. **G. Timberlake** "Automated clinical visual acuity testing" *Am.J. of ophthalmology 90:369-373,(1980)*
9. **H. V. Nema** "Text book of Ophthalmology" *First edition, JAYPEE, (1987).*
10. **C. Duncan** "Introductory Biostatics for the Health sciences" *second Editions, America, (1983)*
11. **R. A**. **Weale** " Senile changes in visual acuity " *Trans Ophthalmol Soc. UK 95: 36 38 (1975)*

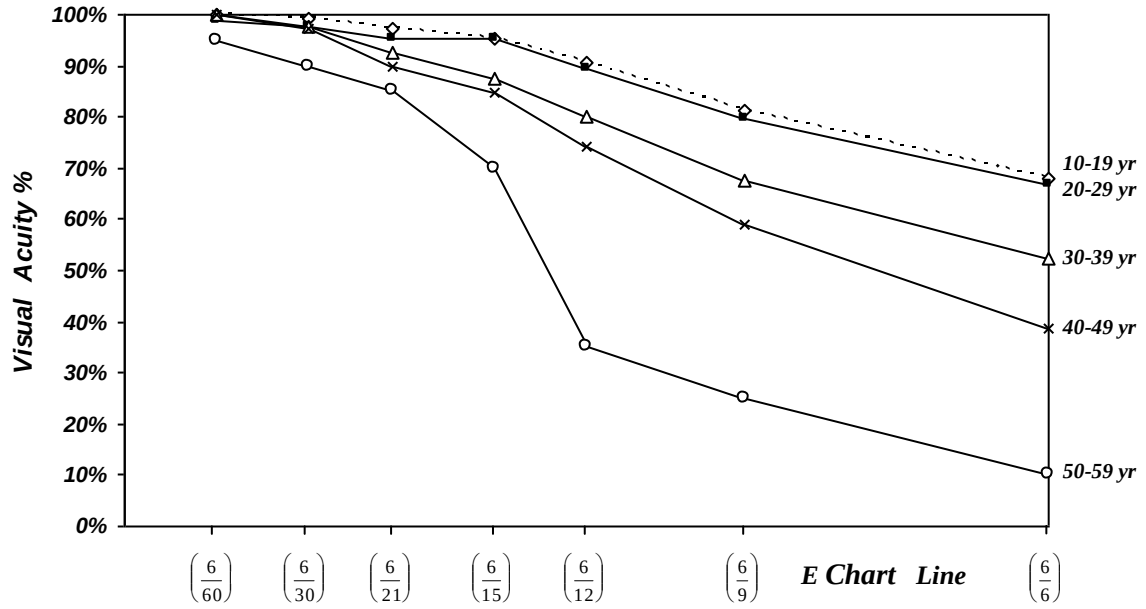

Fig (2): Percent visual acuity of Right eye of male for different age group.

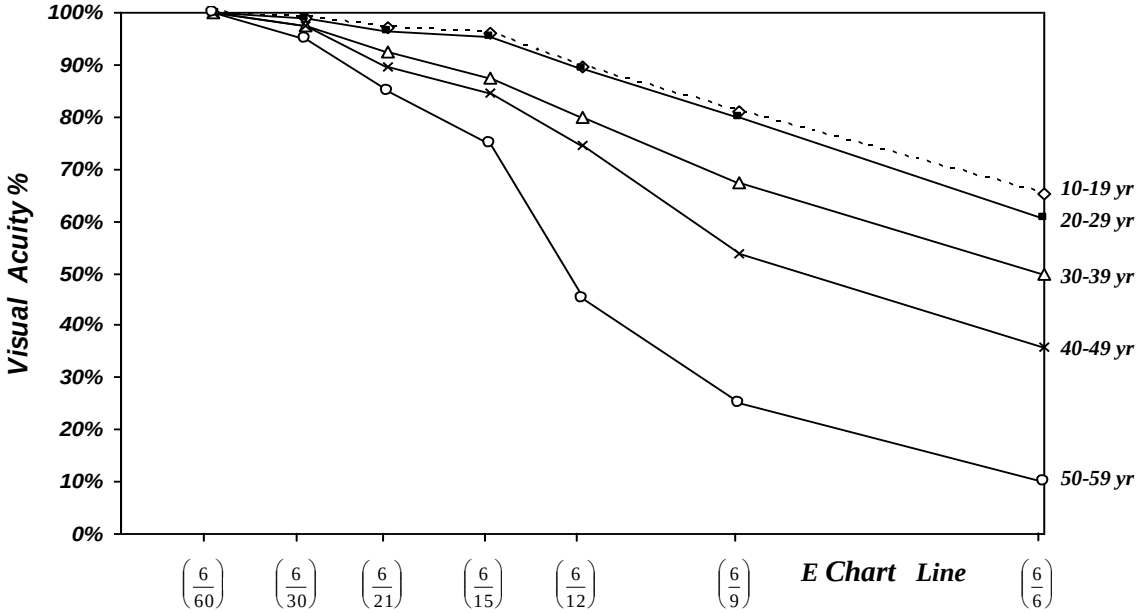

Fig (3): Percent visual acuity of left eye of male for different age groups.

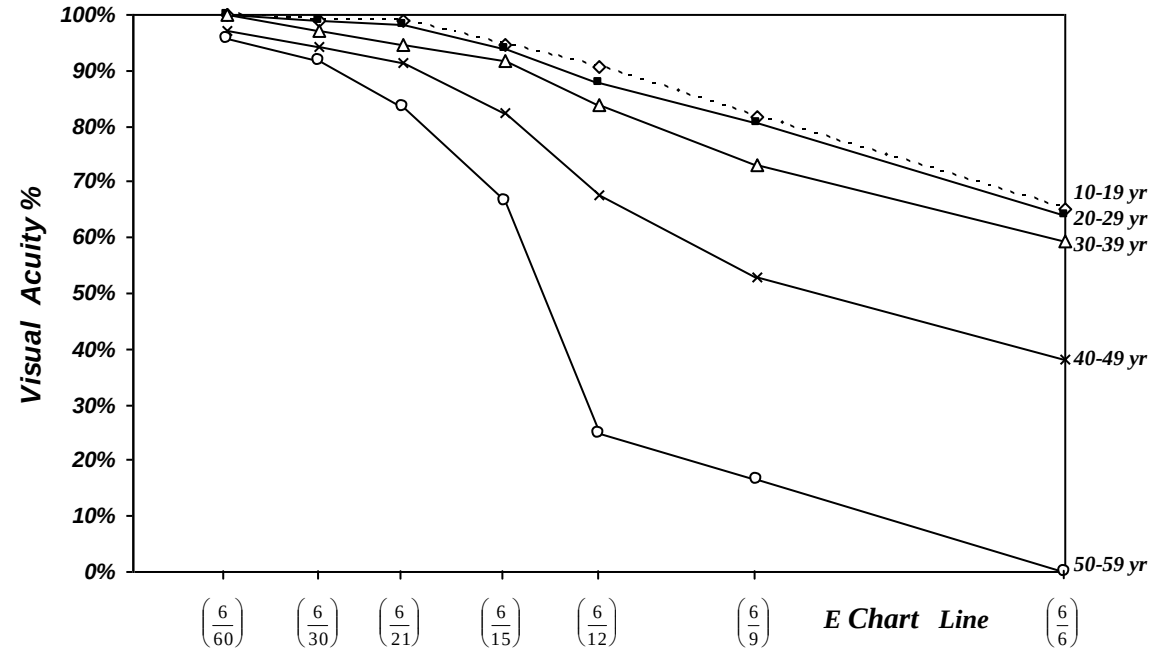

Fig (4): Percent visual acuity of Right eye of female for different age groups.

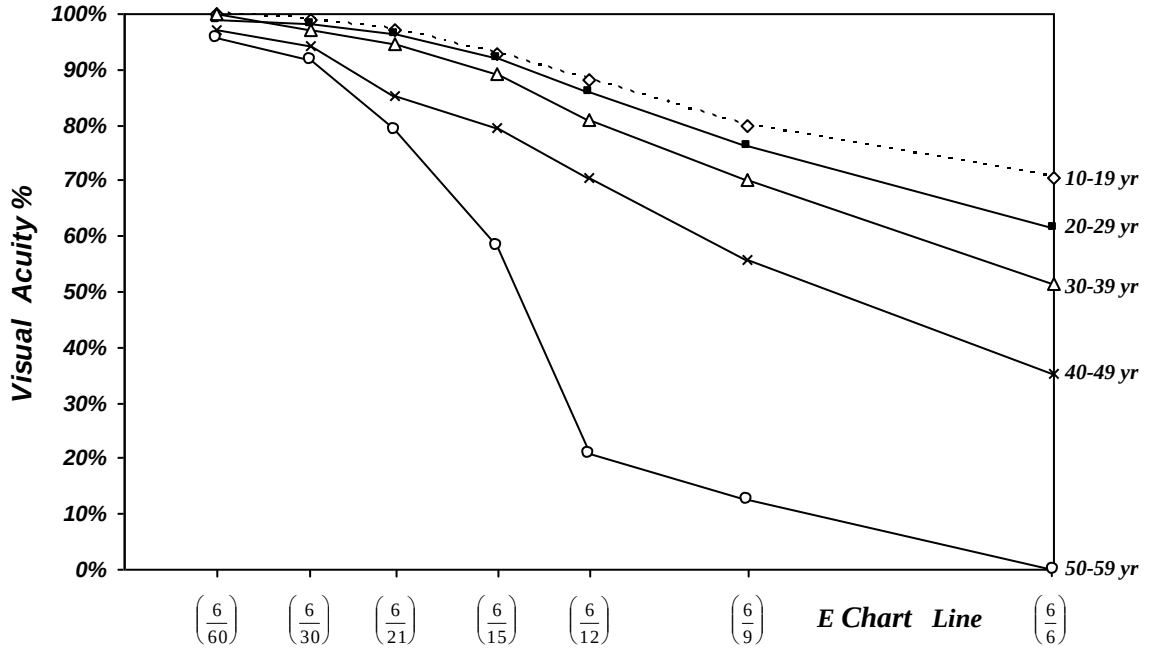

Fig (5): Percent visual acuity of left eye of female for different age groups.

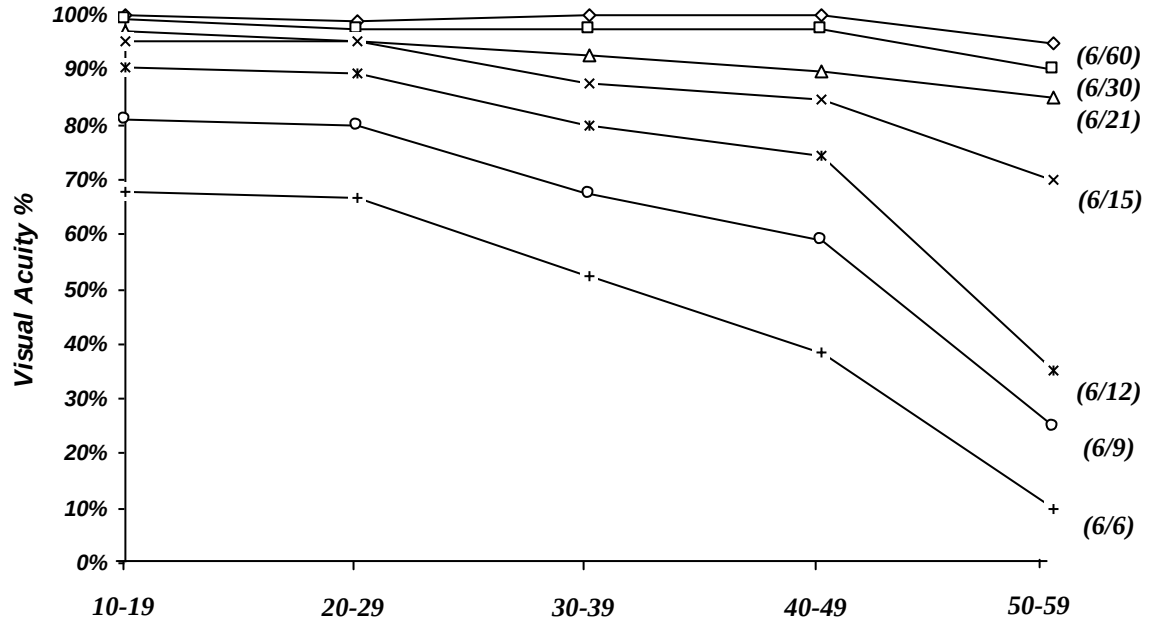

Fig (6) Deterioration of percent visual acuity of Right eye of males with age at different E charts line.

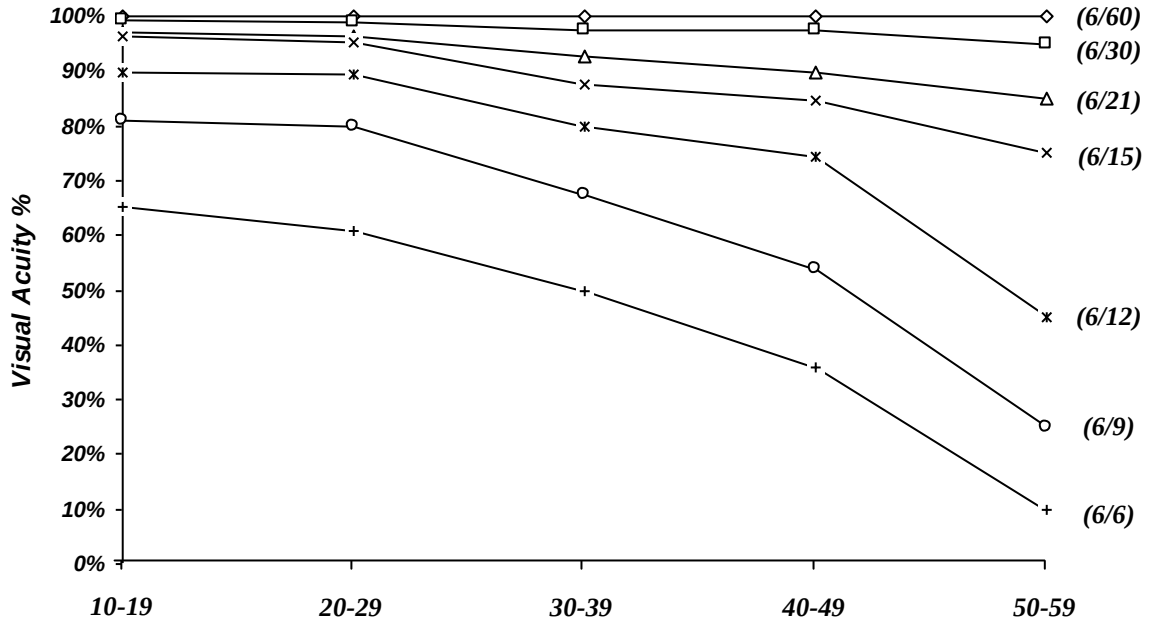

Fig (7) Deterioration of percent visual acuity of left eye of males with age at different E charts line.

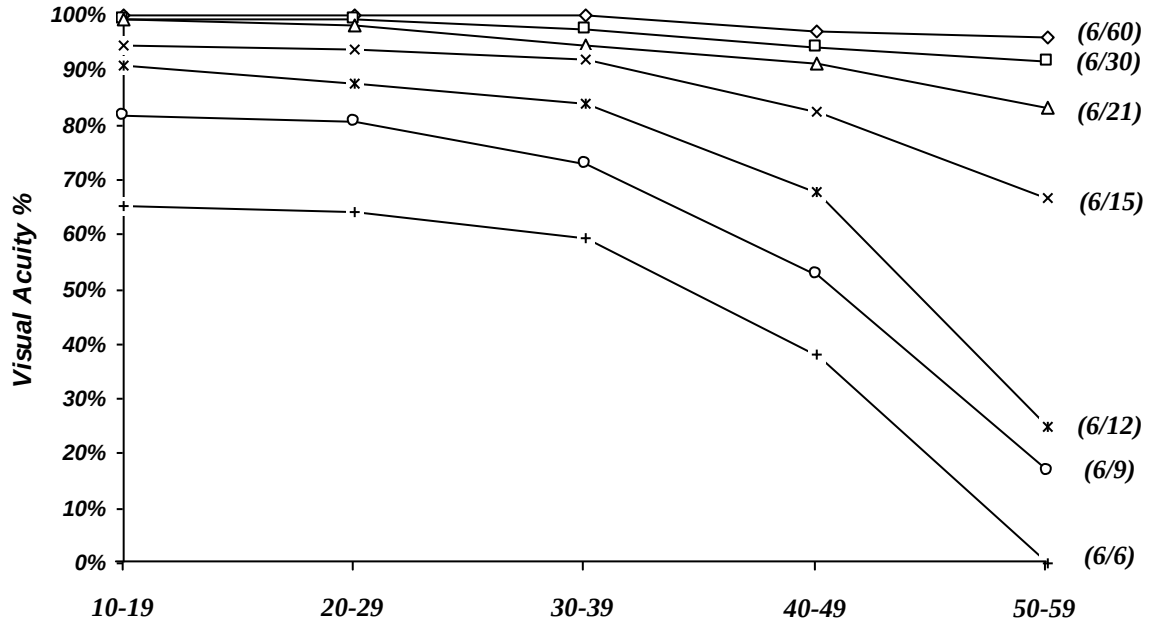

Fig (8) Deterioration of percent visual acuity of right eye of females with age at different E charts line.

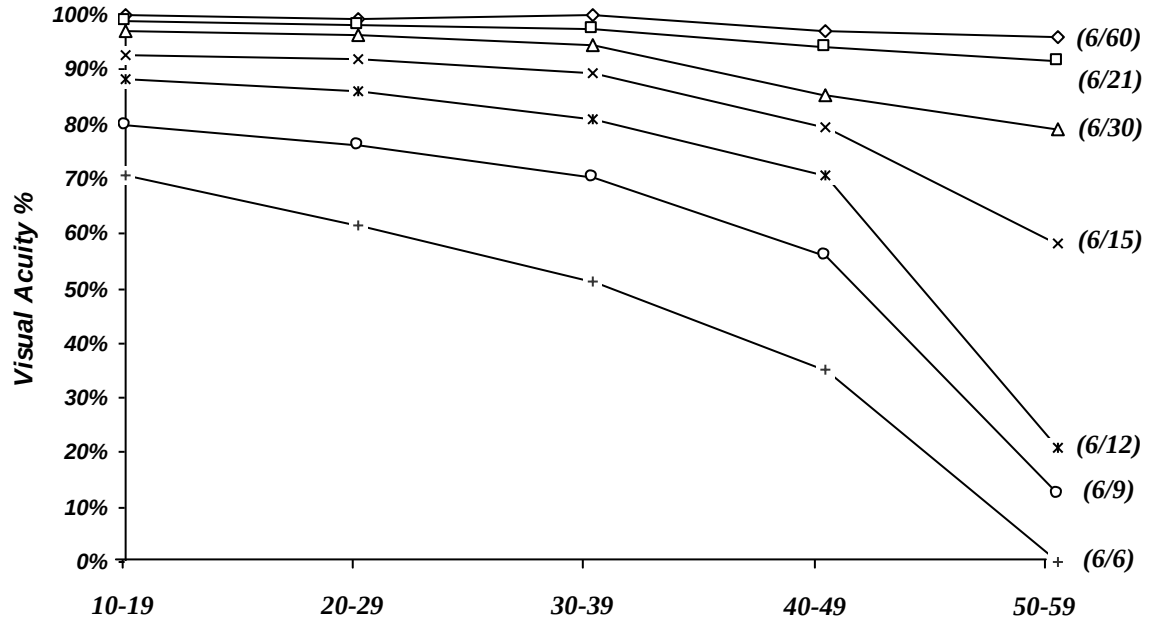

Fig (9) Deterioration of percent visual acuity of left eye of females with age at different E charts line.